



		CHANGE IN HOME-BASED WORK TRAVEL		CHANGE IN TOTAL TRAVEL		CHANGE IN TOTAL VMT	CHANGE IN EMISSIONS		
		Vehicle Trips % Change	Transit Trips % Change	Vehicle Trips % Change	Transit Trips % Change	Veh-Miles % Change	kg of VOC % Change	kg of CO % Change	kg of NO _x % Change
	1996 Base Condition 5-County PA Region Only	2,066,000 (a)	456,000 (a)	10,092,000 (a)	764,000 (a)	71,701,500 (b,c)	79,500 (b)	510,500 (b)	111,000 (b)
ID #	Test Scenario								
13	Application of "transit first" principles in Philadelphia	-1,263 -0.1	1,508 0.3	-2,677 -0.0	3,742 0.5	-9,264 -0.0	-18 -0.0	-74 -0.0	-14 -0.0
14	Reuse of surplus LRVs and trackless trolleys on bus routes in Philadelphia	Not Calculated	Not Calculated	-2,192 -0.0	2,586 0.3	-5,858 -0.0	-6 -0.0	-40 -0.0	-9 -0.0
15	Improve City Transit Division service	-4,579 -0.2	5,343 1.2	-7,800 -0.1	10,604 1.4	-52,512 -0.1	-85 -0.1	-372 -0.1	-81 -0.1
16	Philadelphia to Harrisburg rail service improvements	Not Calculated	Not Calculated	-288 -0.0	360 0.0	-14,212 -0.0	-11 -0.0	-80 -0.0	-24 -0.0
TRANSPORTATION MANAGEMENT PLANS									
17	Implementation of ETRP in Pennsylvania (all APO targets reached)	-161,236 -7.8	55,567 12.2	-161,236 -1.6	55,567 7.3	-1,226,424 -1.7	-1,625 -2.0	-10,415 -2.0	-1,996 -1.8
18	Comprehensive regional ridesharing program (d)	-24,142 -1.2	5,539 1.2	-24,142 -0.2	5,539 0.7	-184,256 -0.3	-272 -0.3	-1,399 -0.3	-295 -0.3



		CHANGE IN HOME-BASED WORK TRAVEL		CHANGE IN TOTAL TRAVEL		CHANGE IN TOTAL VMT	CHANGE IN EMISSIONS		
		Vehicle Trips % Change	Transit Trips % Change	Vehicle Trips % Change	Transit Trips % Change	Veh-Miles % Change	kg of VOC % Change	kg of CO % Change	kg of NO _x % Change
	1996 Base Condition 5-County PA Region Only	2,066,000 (a)	456,000 (a)	10,092,000 (a)	764,000 (a)	71,701,500 (b,c)	79,500 (b)	510,500 (b)	111,000 (b)
ID #	Test Scenario								
19	Availability and promotion of \$25 Transitchek (d)	-12,348 -0.6	7,467 1.6	-12,348 -0.1	7,467 1.0	-84,792 -0.1	-108 -0.1	-634 -0.1	-128 -0.1
20	Telecommuting (d)	-48,306 -2.3	-20,289 -4.5	-48,306 -0.5	-20,289 -2.7	-388,368 -0.5	-532 -0.7	-3,005 -0.6	-619 -0.6
21	Compressed work weeks (9/80)	-21,440 -1.0	-4,762 -1.0	-21,440 -0.2	-4,762 -0.6	-162,288 -0.2	-186 -0.2	-1,165 -0.2	-245 -0.2
PARKING MANAGEMENT									
22	Prohibit new construction of parking facilities in Center City	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact
23	Limit parking facilities at new suburban employment sites	-6,720 -0.3	None	-6,720 -0.1	None	-47,613 -0.1	-76 -0.1	-398 -0.1	-72 -0.1
24	\$3.00 parking surcharge paid by all regional employees arriving in private vehicles	-177,922 -8.6	139,772 30.7	-177,922 -1.8	139,772 18.3	-1,373,592 -1.9	-1,725 -2.2	-10,772 -2.1	-2,266 -2.0



		CHANGE IN HOME-BASED WORK TRAVEL		CHANGE IN TOTAL TRAVEL		CHANGE IN TOTAL VMT	CHANGE IN EMISSIONS		
		Vehicle Trips % Change	Transit Trips % Change	Vehicle Trips % Change	Transit Trips % Change	Veh-Miles % Change	kg of VOC % Change	kg of CO % Change	kg of NO _x % Change
	1996 Base Condition 5-County PA Region Only	2,066,000 (a)	456,000 (a)	10,092,000 (a)	764,000 (a)	71,701,500 (b,c)	79,500 (b)	510,500 (b)	111,000 (b)
ID #	Test Scenario								
25	Institute a \$3.00 parking tax in the Phila CBD to be paid by all employees	-45,042 -2.2	48,844 10.7	-45,042 -0.4	48,844 6.4	-392,336 -0.5	-430 -0.5	-2,832 -0.6	-661 -0.6
26	Construct new park and ride lots along highways	None	-1,985 -0.4	None	-1,985 -0.3	-50,616 -0.1	-49 -0.1	-299 -0.1	-78 -0.1
27	Expand parking at rail stations	None	7,352 1.6	None	7,352 1.0	-106,160 -0.1	-101 -0.1	-593 -0.1	-170 -0.2
NON-MOTORIZED PROGRAMS AND FACILITIES									
28	Comprehensive bicycle improvements in the region that would capture 5% of auto work trips ≤ 5 miles	-61,985 -3.0	-13,469 -3.0	-61,985 -0.6	-13,469 -1.8	-92,584 -0.1	-191 -0.2	-931 -0.2	-163 -0.1



		CHANGE IN HOME-BASED WORK TRAVEL		CHANGE IN TOTAL TRAVEL		CHANGE IN TOTAL VMT	CHANGE IN EMISSIONS		
		Vehicle Trips % Change	Transit Trips % Change	Vehicle Trips % Change	Transit Trips % Change	Veh-Miles % Change	kg of VOC % Change	kg of CO % Change	kg of NO _x % Change
	1996 Base Condition 5-County PA Region Only	2,066,000 (a)	456,000 (a)	10,092,000 (a)	764,000 (a)	71,701,500 (b,c)	79,500 (b)	510,500 (b)	111,000 (b)
ID #	Test Scenario								
29	Comprehensive bicycle improvements in the region that would capture 5% of access trips of ≤ 5 miles for work purposes to 14 selected rail stations	-651 -0.0	-63 -0.0	-651 -0.0	-63 -0.0	-1,320 -0.0	-2 -0.0	-11 -0.0	-2 -0.0
30	Comprehensive bicycle improvements in the region that would capture 5% of non- work trips ≤ 5 miles	None	None	-112,712 -1.1	-7,484 -1.0	-160,336 -0.2	-301 -0.4	-1,588 -0.3	-311 -0.3
EMISSIONS REDUCTION PROGRAMS									
31	Removal of 50% of pre-1980 vehicles	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	-4,501 -5.7	-31,076 -6.1	-2,261 -2.0
32	Reduction in cold starts	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	-888 -1.1	-6,671 -1.3	-572 -0.5
33	California cars	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	-517 -0.7	-1,524 -0.3	-720 -0.7



Table 7
Cost Impact Summary

		Annual Public Sector (Govt) Cost and Revenue (a) Annual Private Sector Cost and Revenue (a)						Total Cost Effectiveness (public & private) (d)	
ID #	Test Scenario	Capital Cost	Operating Cost	Revenue	Net Cost	Change in Annual VMT (Veh-miles) (a)	Change in Annual Emissions (tons) (a,b,c)	\$/VMT reduced (a)	\$/ton reduced (a,b,c)
TRAFFIC FLOW IMPROVEMENTS									
1	Advanced signal systems on 50 miles of the most congested 4-lane arterials	\$1,388,657 \$0	\$279,540 \$0	\$0 \$0	\$1,668,197 \$0	-17,636,000	-77	\$0.09	\$21,620
2	Advanced signal system improvements - Comprehensive system for Philadelphia CBD	\$1,964,209 \$0	\$0 \$0	\$0 \$0	\$1,964,209 \$0	-1,834,000	-16	\$1.07	\$125,048
3	Congestion and incident management systems on interstates within Philadelphia and the four suburban counties	\$4,727,215 \$0	\$3,172,000 \$0	\$0 \$0	\$7,899,215 \$0	+3,118,000	-39	\$2.53 (per VMT added)	\$200,452
4	Ramp metering	\$275,705 \$0	\$25,500 \$0	\$0 \$0	\$301,205 \$0	-10,804,000	-112	\$0.03	\$2,699



ID #	Test Scenario	Annual Public Sector (Govt) Cost and Revenue (a) Annual Private Sector Cost and Revenue (a)				Change in Annual VMT (Veh-miles) (a)	Change in Annual Emissions (tons) (a,b,c)	Total Cost Effectiveness (public & private) (d)	
		Capital Cost	Operating Cost	Revenue	Net Cost			\$/VMT reduced (a)	\$/ton reduced (a,b,c)
5	Enforce adherence to 55 mph speed limit on PA Turnpike	\$0 \$0	\$2,240,000 \$0	\$0 \$0	\$2,240,000 \$0	Not Applicable	-201	NA	\$11,166
TRANSIT OPERATIONS									
6	Restoration of service on regional rail lines	\$4,583,349 \$0	\$3,636,360 \$0	\$1,599,998 \$0	\$6,619,711 \$0	-2,590,000	-8	\$2.56	\$857,915
7	Extension of Route 66 trackless trolley	\$1,273,153 \$0	\$70,070 \$0	\$30,940 \$0	\$1,312,283 \$0	-340,000	-1	\$3.86	\$952,402
8	Improvement to express service on regional rail lines	\$469,668 \$0	\$1,330,420 \$0	\$585,385 \$0	\$1,214,703 \$0	-3,688,000	-11	\$0.33	\$110,198
9	Systemwide fare reductions of 10%	\$2,106,240 \$0	\$6,582,000 \$0	\$2,606,472 \$0	\$6,081,768 \$0	-18,372,000	-56	\$0.33	\$109,255
10	Systemwide fare reductions of 20%	\$3,755,680 \$0	\$11,736,500 \$0	\$4,131,248 \$0	\$11,360,932 \$0	-36,004,000	-115	\$0.32	\$99,102
11	Systemwide fare reductions of 50%	\$9,421,440 \$0	\$29,442,000 \$0	\$6,477,240 \$0	\$32,386,200 \$0	-90,608,000	-289	\$0.36	\$112,247



ID #	Test Scenario	Annual Public Sector (Govt) Cost and Revenue (a) Annual Private Sector Cost and Revenue (a)				Change in Annual VMT (Veh-miles) (a)	Change in Annual Emissions (tons) (a,b,c)	Total Cost Effectiveness (public & private) (d)	
		Capital Cost	Operating Cost	Revenue	Net Cost			\$/VMT reduced (a)	\$/ton reduced (a,b,c)
12	Improve suburban bus service	\$437,760 \$0	\$2,649,600 \$0	\$1,175,040 \$0	\$1,912,320 \$0	-13,500,000	-42	\$0.14	\$45,356
13	Application of "transit first" principles in Philadelphia	\$533,411 \$0	\$991,630 \$0	\$439,685 \$0	\$1,085,356 \$0	-2,316,000	-9	\$0.47	\$123,079
14	Reuse of surplus LRVs and trackless trolleys on bus routes in Philadelphia	\$0 \$0	\$685,290 \$0	\$303,855 \$0	\$381,435 \$0	-1,464,500	-4	\$0.26	\$92,277
15	Improve City Transit Division service	\$253,793 \$0	\$3,048,650 \$0	\$1,352,010 \$0	\$1,950,433 \$0	-13,128,000	-46	\$0.15	\$42,637
16	Philadelphia to Harrisburg rail service improvements	\$4,484,700 \$0	\$2,252,700 \$0	\$739,800 \$0	\$5,943,600 \$0	-3,553,000	-10	\$1.67	\$619,774
TRANSPORTATION MANAGEMENT PLANS									
17	Implementation of ETRP in Pennsylvania (all APO targets reached)	\$8,890,720 \$0	\$36,119,439 \$114,690,255	\$12,224,740 \$184,046,340	\$32,785,419 -\$69,356,085	-306,606,000	-998	-\$0.12	-\$36,649



TRANSPORTATION CONTROL MEASURES

ID #	Test Scenario	Annual Public Sector (Govt) Cost and Revenue (a) Annual Private Sector Cost and Revenue (a)				Change in Annual VMT (Veh-miles) (a)	Change in Annual Emissions (tons) (a,b,c)	Total Cost Effectiveness (public & private) (d)	
		Capital Cost	Operating Cost	Revenue	Net Cost			\$/VMT reduced (a)	\$/ton reduced (a,b,c)
18	Comprehensive regional ridesharing program	\$0 \$0	\$750,000 \$853,505	\$0 \$0	\$750,000 \$853,505	-46,064,000	-156	\$0.03	\$10,262
19	Availability and promotion of \$25 Transitchek	\$1,194,720 \$0	\$4,195,679 \$4,621,792	\$1,642,740 \$0	\$3,747,659 \$4,621,792	-21,198,000	-65	\$0.39	\$128,691
20	Telecommuting	\$0 \$0	-\$10,144,500 \$10,207,817	-\$4,463,580 \$0	-\$5,680,920 \$10,207,817	-97,092,000	-317	\$0.05	\$14,272
21	Compressed work weeks (9/80)	\$0 \$0	-\$2,381,000 \$0	-\$1,047,640 \$0	-\$1,333,360 \$0	-40,572,000	-119	-\$0.03	-\$11,226
PARKING MANAGEMENT									
22	Prohibit new construction of parking facilities in Center City	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact
23	Limit parking facilities at new suburban employment sites	\$0 -\$1,368,894	\$0 \$0	\$0 \$0	\$0 -\$1,368,894	-11,903,213	-41	-\$0.12	-\$33,728



ID #	Test Scenario	Annual Public Sector (Govt) Cost and Revenue (a) Annual Private Sector Cost and Revenue (a)				Change in Annual VMT (Veh-miles) (a)	Change in Annual Emissions (tons) (a,b,c)	Total Cost Effectiveness (public & private) (d)	
		Capital Cost	Operating Cost	Revenue	Net Cost			\$/VMT reduced (a)	\$/ton reduced (a,b,c)
24	\$3.00 parking surcharge paid by all regional employees arriving in private vehicles	\$22,363,520 \$0	\$70,386,000 \$20,275,332	\$30,749,840 \$561,696,750	\$61,999,680 -\$541,421,418	-343,398,000	-1,100	-\$1.40	-\$435,912
25	Institute a \$3.00 parking tax in the Phila CBD to be paid by all employees	\$7,815,040 \$0	\$24,672,000 \$2,072,868	\$10,745,680 \$37,015,500	\$21,741,360 -\$34,942,632	-98,084,000	-301	-\$0.13	-\$43,909
26	Construct new park and ride lots along highways	\$3,390,057 \$0	\$1,956,375 \$0	\$447,040 \$0	\$4,899,392 \$0	-12,654,000	-35	\$0.39	\$139,991
27	Expand parking at rail stations	\$4,427,257 \$0	\$6,487,000 \$0	\$2,502,280 \$0	\$8,411,977 \$0	-26,540,000	-75	\$0.32	\$112,640
NON-MOTORIZED PROGRAMS AND FACILITIES									
28	Comprehensive bicycle improvements in the region that would capture 5% of auto work trips ≤ 5 miles	\$2,016,017 \$5,265,510	-\$4,512,115 \$0	-\$1,985,331 \$0	-\$510,768 \$5,265,510	-23,146,000	-98	\$0.21	\$48,740



ID #	Test Scenario	Annual Public Sector (Govt) Cost and Revenue (a) Annual Private Sector Cost and Revenue (a)				Change in Annual VMT (Veh-miles) (a)	Change in Annual Emissions (tons) (a,b,c)	Total Cost Effectiveness (public & private) (d)	
		Capital Cost	Operating Cost	Revenue	Net Cost			\$/VMT reduced (a)	\$/ton reduced (a,b,c)
29	Comprehensive bicycle improvements in the region that would capture 5% of access trips of ≤ 5 miles for work purposes to 14 selected rail stations	\$84,033 \$0	-\$21,105 \$0	-\$9,286 \$0	\$72,214 \$0	-330,000	-1	\$0.22	\$65,513
30	Comprehensive bicycle improvements in the region that would capture 5% of non-work trips ≤ 5 miles	\$164,537 \$2,393,563	\$0 \$0	-\$1,103,142 \$0	\$1,267,679 \$2,393,563	-40,084,000	-169	\$0.09	\$21,709
EMISSIONS REDUCTION PROGRAMS									
31	Removal of 50% of pre-1980 vehicles	\$99,750,000 \$0	\$7,125,000 \$0	\$0 \$0	\$106,875,000 \$0	Not Applicable	-1,863	Not Applicable	\$57,354
32	Reduction in cold starts	\$0 \$0	\$750,000 \$0	\$0 \$0	\$750,000 \$0	Not Applicable	-402	Not Applicable	\$1,864



ID #	Test Scenario	Total Cost Effectiveness (\$000/ton reduced) (a)	Change in Annual Emissions (tons) (b)	Change in Annual VMT (millions of veh-miles)	Total Cost Effectiveness (\$/VMT reduced) (a)
29	Bike captures 5% of rail Access trips \leq 5 miles for work purposes to 14 rail stations	\$65.5	-1	-0.3	\$0.22
14	Reuse surplus LRVs on bus routes in Phila	\$92.3	-4	-1.5	\$0.26
10	20% system-wide transit fare reduction	\$99.1	-115	-36.0	\$0.32
9	10% system-wide transit fare reduction	\$109.3	-56	-18.4	\$0.33
8	Improvement to express service on regional rail lines	\$110.2	-11	-3.7	\$0.33
11	50% system-wide transit fare reduction	\$112.2	-289	-90.6	\$0.36
27	Expand parking at rail stations	\$112.6	-75	-26.5	\$0.32
13	Apply "Transit-First" in Phila CBD	\$123.1	-9	-2.3	\$0.47
2	Advanced signal system in Phila CBD	\$125.0	-16	-1.8	\$1.07
19	\$25 TransitChek	\$128.7	-65	-21.2	\$0.39
26	New park and ride lots along highways	\$140.0	-35	-12.7	\$0.39
3	CIMS on interstate system	\$200.5	-39	+3.1	\$2.53(c)
16	Philadelphia to Harrisburg rail service improvements	\$619.8	-10	-3.6	\$1.67
6	Restoration of service on regional rail lines	\$857.9	-8	-2.6	\$2.56
7	Extension of Rte 66 trackless trolley	\$952.4	-1	-0.3	\$3.86
22	Prohibit new parking facilities in Center City	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact

(a) = A negative value in the Cost-Effectiveness column indicates that the measure will generate revenue

(b) = Each ton of emissions is the sum of VOC and NO_x

(c) = \$2.53 per VMT *added*



Table 10
Test Scenarios Ranked in Order of Cost-Effectiveness

ID #	Test Scenario	Total Cost Effectiveness (\$000/ton reduced) (a)	Change in Annual Emissions (tons) (b)	Change in Annual VMT (millions of veh-miles)	Total Cost Effectiveness (\$/VMT reduced) (a)
24	\$3 parking surcharge paid by all regional employees	-\$435.9	-1100	-343.4	-\$1.40
35	\$.84 per gallon gas tax	-\$205.5	-3486	-1309.1	-\$0.55
36	\$.04 per vehicle mile travelled tax	-\$205.4	-3486	-1309.1	-\$0.55
25	\$3 parking tax in Philadelphia CBD	-\$43.9	-301	-98.1	-\$0.13
17	Implementation of PA ETRP (all APO targets reached)	-\$36.6	-998	-306.6	-\$0.12
23	Limit parking facilities at new suburban employment sites	-\$33.7	-41	-11.9	-\$0.12
21	Compressed work weeks (9/80)	-\$11.2	-119	-40.6	-\$0.03
37	Facility pricing (double Turnpike tolls during peak periods)	\$0.0	-2	NA	NA
32	Reduction in cold starts	\$1.9	-402	NA	NA
4	Ramp metering	\$2.7	-112	-10.8	\$0.03
34	Feebate on new car purchase	\$4.4	-114	NA	NA
18	Comprehensive regional ridesharing program	\$10.3	-156	-46.1	\$0.03
33	California cars	\$10.9	-341	NA	NA
5	Enforce 55 mph speed limit on PA Tpk	\$11.2	-201	NA	NA
20	Telecommuting	\$14.3	-317	-97.1	\$0.05
1	Advanced signal system on 4-lane arterials	\$21.6	-77	-17.6	\$0.09
30	Bike captures 5% of non-work trips ≤ 5 miles	\$21.7	-169	-40.1	\$0.09
15	Improve City Transit Division service	\$42.6	-46	-13.1	\$0.15
12	Improve suburban bus service	\$45.4	-42	-13.5	\$0.14
28	Bike captures 5% of auto work trips ≤ 5 miles	\$48.7	-98	-23.1	\$0.21
31	Removal of 50% of pre-1980 vehicles	\$57.4	-1863	NA	NA



ID #	Test Scenario	Change in Annual Emissions (tons) (a)	Total Cost Effectiveness (\$000/ton reduced) (b)	Change in Annual VMT (millions of veh-miles)	Total Cost Effectiveness (\$/VMT reduced) (b)
15	Improve City Transit Division service	-46	\$42.6	-13.1	\$0.15
12	Improve suburban bus service	-42	\$45.4	-13.5	\$0.14
23	Limit parking facilities at new suburban employment sites	-41	-\$33.7	-11.9	-\$0.12
3	CIMS on interstate system	-39	\$200.5	+3.1	\$2.53(c)
26	New park and ride lots along highways	-35	\$140.0	-12.7	\$0.39
2	Advanced signal system in Phila CBD	-16	\$125.0	-1.8	\$1.07
8	Improvement to express service on regional rail lines	-11	\$110.2	-3.7	\$0.33
16	Philadelphia to Harrisburg rail service improvements	-10	\$619.8	-3.6	\$1.67
13	Apply "Transit-First" in Phila CBD	-9	\$123.1	-2.3	\$0.47
6	Restoration of service on regional rail lines	-8	\$857.9	-2.6	\$2.56
14	Reuse surplus LRVs on bus routes in Phila	-4	\$92.3	-1.5	\$0.26
37	Facility pricing (double Turnpike tolls during peak periods)	-2	\$0.0	NA	NA
29	Bike captures 5% of access trips ≤ 5 for work purposes to 14 rail stations	-1	\$65.5	-0.3	\$0.22
7	Extension of Rte 66 trackless trolley	-1	\$952.4	-0.3	\$3.86
22	Prohibit new parking facilities in Center City	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact

(a) = Each ton of emissions is the sum of VOC and NO_x

(b) = A negative value in the Cost-Effectiveness column indicates that the measure will generate revenue

(c) = \$2.53 per VMT *added*



Table 9
Test Scenarios Ranked in Order of Emissions Reduction Potential

ID #	Test Scenario	Change in Annual Emissions (tons) (a)	Total Cost Effectiveness (\$000/ton reduced) (b)	Change in Annual VMT (millions of veh-miles)	Total Cost Effectiveness (\$/VMT reduced) (b)
35	\$.84 per gallon gas tax	-3486	-\$205.5	-1309.1	-\$0.55
36	\$.04 per vehicle mile travelled tax	-3486	-\$205.4	-1309.1	-\$0.55
31	Removal of 50% of pre-1980 vehicles	-1863	\$57.4	NA	NA
24	\$3 parking surcharge paid by all regional employees	-1100	-\$435.9	-343.4	-\$1.40
17	Implementation of PA ETRP (all APO targets reached)	-998	-\$36.6	-306.6	-\$0.12
32	Reduction in cold starts	-402	\$1.9	NA	NA
33	California cars	-341	\$10.9	NA	NA
20	Telecommuting	-317	\$14.3	-97.1	\$0.05
25	\$3 parking tax in Philadelphia CBD	-301	-\$43.9	-98.1	-\$0.13
11	50% system-wide transit fare reduction	-289	\$112.2	-90.6	\$0.36
5	Enforce 55 mph speed limit on PA Tpk	-201	\$11.2	NA	NA
30	Bike captures 5% of non-work trips ≤ 5 miles	-169	\$21.7	-40.1	\$0.09
18	Comprehensive regional ridesharing program	-156	\$10.3	-46.1	\$0.03
21	Compressed work weeks (9/80)	-119	-\$11.2	-40.6	-\$0.03
10	20% system-wide transit fare reduction	-115	\$99.1	-36.0	\$0.32
34	Feebate on new car purchase	-114	\$4.4	NA	NA
4	Ramp metering	-112	\$2.7	-10.8	\$0.03
28	Bike captures 5% of auto work trips ≤ 5 miles	-98	\$48.7	-23.1	\$0.21
1	Advanced signal system on 4-lane arterials	-77	\$21.6	-17.6	\$0.09
27	Expand parking at rail stations	-75	\$112.6	-26.5	\$0.32
19	\$25 TransitChek	-65	\$128.7	-21.2	\$0.39
9	10% system-wide transit fare reduction	-56	\$109.3	-18.4	\$0.33



ID #	Test Scenario	Change in Annual VMT (millions of veh-miles)	Total Cost Effectiveness (\$/VMT reduced) (a)	Change in Annual Emissions (tons) (b)	Total Cost Effectiveness (\$000/ton reduced) (a)
21	Compressed work weeks (9/80)	-40.6	-\$0.03	-119	-\$11.2
Parking Management					
22	Prohibit new parking facilities in Center City	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact
23	Limit parking facilities at new suburban employment sites	-11.9	-\$0.12	-41	-\$33.7
24	\$3 parking surcharge paid by all regional employees	-343.4	-\$1.40	-1100	-\$435.9
25	\$3 parking tax in Philadelphia CBD	-98.1	-\$0.13	-301	-\$43.9
26	New park and ride lots along highways	-12.7	\$0.39	-35	\$140.0
27	Expand parking at rail stations	-26.5	\$0.32	-75	\$112.6
Non-Motorized Programs & Facilities					
28	Bike captures 5% of auto work trips ≤ 5 miles	-23.1	\$0.21	-98	\$48.7
29	Bike captures 5% of access trips ≤ 5 miles for work purposes to 14 rail stations	-0.3	\$0.22	-1	\$65.5
30	Bike captures 5% of non-work trips ≤ 5 miles	-40.1	\$0.09	-169	\$21.7
Emissions Reduction Programs					
31	Removal of 50% of pre-1980 vehicles	NA	NA	-1863	\$57.4
32	Reduction in cold starts	NA	NA	-402	\$1.9
33	California cars	NA	NA	-341	\$10.9
Pricing Mechanisms					
34	Feebate on new car purchase	NA	NA	-114	\$4.4
35	\$.84 per gallon gas tax	-1309.1	-\$0.55	-3486	-\$205.5
36	\$.04 per vehicle mile travelled tax	-1309.1	-\$0.55	-3486	-\$205.4
37	Facility pricing (double Turnpike tolls during peak periods)	NA	NA	-2	\$0.0

(a) = A negative value in the Cost-Effectiveness column indicates that the measure will generate revenue

(b) = Each ton of emissions is the sum of VOC and NO_x

(c) = \$2.53 per VMT added



Table 8
TCM Test Scenarios Grouped by Strategy Type

ID #	Test Scenario	Change in Annual VMT (millions of veh-miles)	Total Cost Effectiveness (\$/VMT reduced) (a)	Change in Annual Emissions (tons) (b)	Total Cost Effectiveness (\$000/ton reduced) (a)
Traffic Flow Improvements					
1	Advanced signal system on 4-lane arterials	-17.6	\$0.09	-77	\$21.6
2	Advanced signal system in Phila CBD	-1.8	\$1.07	-16	\$125.0
3	CIMS on interstate system	+3.1	\$2.53(c)	-39	\$200.5
4	Ramp metering	-10.8	\$0.03	-112	\$2.7
5	Enforce 55 mph speed limit on PA Tpk	NA	NA	-201	\$11.2
Transit Operations					
6	Restoration of service on regional rail lines	-2.6	\$2.56	-8	\$857.9
7	Extension of Rte 66 trackless trolley	-0.3	\$3.86	-1	\$952.4
8	Improvement to express service on regional rail lines	-3.7	\$0.33	-11	\$110.2
9	10% system-wide transit fare reduction	-18.4	\$0.33	-56	\$109.3
10	20% system-wide transit fare reduction	-36.0	\$0.32	-115	\$99.1
11	50% system-wide transit fare reduction	-90.6	\$0.36	-289	\$112.2
12	Improve suburban bus service	-13.5	\$0.14	-42	\$45.4
13	Apply "Transit-First" in Phila CBD	-2.3	\$0.47	-9	\$123.1
14	Reuse surplus LRVs on bus routes in Phila	-1.5	\$0.26	-4	\$92.3
15	Improve City Transit Division service	-13.1	\$0.15	-46	\$42.6
16	Philadelphia to Harrisburg rail service improvements	-3.6	\$1.67	-10	\$619.8
Transportation Management Plans					
17	Implementation of PA ETRP (all APO targets reached)	-306.6	-\$0.12	-998	-\$36.6
18	Comprehensive regional ridesharing program	-46.1	\$0.03	-156	\$10.3
19	\$25 TransitChek	-21.2	\$0.39	-65	\$128.7
20	Telecommuting	-97.1	\$0.05	-317	\$14.3



Table 11
TCM Emissions Reduction Potential Versus Cost-Effectiveness

Emissions Reduction	Revenue-Producing TCMs	Cost: \$0 to \$25,000 per ton	Cost: \$26,000 to \$100,000 per ton	Cost: > \$100,000 per ton
> 1,000 annual tons	\$3 parking surcharge on all employees \$.84 per gallon gas tax \$.04 per vehicle mile travelled tax		Removal of pre-1980 vehicles	
301 - 1,000 annual tons	Implementation of ETRP \$3 parking tax on all CBD employees	California cars Telecommuting Reduction in cold starts		
101 - 300 annual tons	Compressed work week	Ramp metering Enforce 55 mph limit on Turnpike Comprehensive regional rideshare prgm Feebate on new car purchase Bike captures 5% non-work trips ≤ 5 miles	20% transit fare reduction	50% transit fare reduction
11 - 100 annual tons	Limit parking facilities at new suburban sites	Advanced signal system on 4-lane arterials	Improve suburban bus service Improve City Transit Division service Bike captures 5% auto work trips ≤ 5 miles	Advanced signal system in Phila CBD CIMS on interstates Improvements to RR express service 10% transit fare reduction \$25 per month Transitchek New park and ride lots Expand rail station P&R lots
1 - 10 annual tons		Facility pricing (double Turnpike tolls)	Reuse surplus LRVs on bus rts in Phila Bike captures 5% of access trips ≤ 5 miles to rail stations for work purposes	Service restoration on RR lines Extension of Rt 66 trackless trolley "Transit-First" in CBD Improve Phila-Harrisburg rail service



4 POLICY IMPLICATIONS AND DIRECTIONS

The TCM analysis provides a valuable base of information with which to form policy recommendations that will guide the content of future SIPs, Transportation Improvement Programs (TIPs), Transportation Plans, and Work Programs. The results of the analysis raise numerous policy questions for consideration by the DVRPC Board, some of which follow.

Pricing Measures

Should the Board recommend that the states pursue pricing strategies for incorporation into the SIP? Measures such as gas taxes, vehicle miles travelled taxes, and parking charges have the highest emission reduction potential and are the most cost-effective. In fact, pricing strategies usually produce revenue, which can be used to subsidize other worthwhile but less cost-effective projects such as transit fare reductions.

On the other hand, pricing strategies will be the most difficult and time consuming strategies to implement. They require state initiation or legislative action and will undoubtedly spur public opposition and political disputes. Even though pricing strategies offer the highest potential benefit, it may be unwise to concentrate on projects where the consensus necessary for implementation cannot be guaranteed.

Transit Capital Measures

Should the Board recommend any transit capital projects for incorporation into the SIP? Although transit measures such as rail service extensions and restorations have lower emission reduction potential and are less cost-effective in the short term than other types of strategies, their effectiveness may significantly increase over a longer time frame since transit capital improvements assure a *permanent* alternative to single occupant vehicles. Whether placed in the SIP or not, transit projects will continue to be actively pursued in the TIP and work program.

Region-Implementable Measures

Should the Board recommend pursuing the strategies that can be implemented through the region's planning and programming process even if they demonstrate only moderate emission reduction potential and cost-effectiveness? These types of measures include bicycle improvements, transit operational improvements, selected measures to reduce traffic congestion and delay, and financial support for ridesharing and other transportation demand management programs.

Since these types of strategies can be carried out at the regional level, implementation can occur more quickly and easily than for projects that require state action.



ETRP and Related Strategies

Should the Board recommend continued support and endorsement of the ETRP and related strategies? The analysis indicates that a full scale effort in which all of the employers meet their trip reductions goals can be successful in reducing emissions and cost-effective.

However, it is doubtful that all employers will reach their targets — in fact, several nation-wide studies estimate that ETRPs will result in relatively small emissions reductions. In addition, some local businesses actively oppose the ETRP, claiming it will produce minimal benefits at a very high cost.

Technical Measures

Should the Board recommend that the states continue to exploit technological means to reduce emissions? Advancing technological measures such as reformulated fuels, reductions in Reid Vapor Pressure (RVP), and California Low-Emission Vehicle Standards can lead to significant emissions reductions.

However, it may be unnecessary to become involved in pursuing these types of strategies, since they are and will continue to be under the purview of the EPA and the Ozone Transport Commission.

Educational Efforts

Should the Board recommend that the states continue to promote behavioral changes through educational programs? Although educational programs in and of themselves will not reduce emissions, they will build a necessary constituency for air quality measures. The fact that recycling is now considered a normal part of everyday life illustrates the potential effectiveness of a large scale educational program.

However, the highly visible, on-going, multi-media campaign necessary for a successful air quality educational program will require considerable financial resources. Since only limited funds are available, projects with more tangible results may take precedence.

DVRPC's role in project implementation must also be examined in the policy making process. For strategies that are the state's responsibility, DVRPC's role may be limited to adopting a resolution of endorsement or support. For strategies that can be initiated at the regional level, DVRPC will be actively involved in transforming the test scenarios into actual projects, building consensus for the projects, and carrying them through the planning and programming process.

The next step in the TCM development process will be to generate formal policy recommendations along with a detailed action plan that will help the region focus its resources. Any future recommendations, plans, or additional analysis precipitated by this report will be documented in the form of report supplements.

APPENDICES



Appendix A: Travel Demand Management Evaluation Model

Overview of Technique

A number of TCMs were evaluated through a special analytic tool called the TDM Evaluation Model. The TDM Model was developed by COMSIS Corporation of Silver Spring, Maryland for the express purpose of quick, quantitative analysis of the travel impacts of Travel Demand Management strategies. This model was developed in the late 1980's by COMSIS, drawing upon its nationwide research in TDM, and is in use by numerous Metropolitan Planning Organizations around the country. A public-domain version of the TDM Model was sponsored by the Federal Highway Administration in 1993, and is now being released through McTrans.

The TDM Model is a self-contained software package that operates on a microcomputer. The user inputs scenario assumptions on a system of worksheet screens. Strategies may be tested individually or in combination, where interactive effects are accounted for. Input data is generally in the form of trip tables, although surveys or other sources may be used.

The model is essentially a "pivot point" technique; this means that it discerns the current condition of the travel environment from the modal split of the background travel data, and then projects the change in modal split due to the tested policies or strategies as departures from this starting point. Thus, it is not necessary to compile detailed information on starting conditions. While this is the model's strength, it is also its limitation — the TDM Model does not operate at the same level of detail as the regional mode choice model (within the 4 step process).

The TDM Model was designed to be (1) a quick, reasonably accurate, and interactive "policy" tool, and (2) a device capable of providing quantitative estimates of TDM strategies, such as employer support measures and alternative work hours, which are not readily handled by existing transportation planning models. It also has special faculties to deal with partial "participation" of the employment base, such as might happen when adoption of TDM is elective or imposed on only a portion of the population, such as employers of 100 or more.

Types of Strategies

A wide range of strategies can be examined in the TDM model. Mainly, the model was developed to address employer-based TDM. However, it can also look at areawide measures, such as transit improvements, HOV lanes, and a range of pricing actions. The following list highlights the measures that can be examined with the TDM Model.

Employer Support Measures:

- Information programs
 - Employer transportation coordinators
-



Flexible work schedules
 Rideshare matching
 Vanpool formation and support
 Transit pass sales
 Preferential parking for HOVs
 Guaranteed ride home

Alternate Work Schedules:

Flexible work hours
 Staggered work hours
 Compressed work weeks (4/40 and 9/80)
 Telecommuting

Financial Incentives and Disincentives:



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